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3 January 1979

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AFRICA

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TRANSLATIONS ON SUB-SAHARAN AFRICA

FOUO No. 618

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___Burundi	___Kenya	___Sierra Leone	
X Cameroon	___Lesotho	___Somalia	
___Cape Verde	___Liberia	___South Africa	
X Central African Empire	___Madagascar	___Swaziland	
___Chad	___Malawi	___Tanzania	
___Comoro Islands	___Mali	___Togo	
X Congo	___Mauritius	___Uganda	
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INTER-AFRICAN AFFAIRS

DEVELOPMENT OF ELECTRIC POWER IN AFRICA DESCRIBED

Description of UPDEA

Paris INDUSTRIES ET TRAVAUX D'OUTRE-MER in French Nov 78 pp 807-808

[Article by Lambert Konan, general director of the Ivory Coast Electrical Energy Company and honorary UPDEA president]

[Text] It was as a timid auditor that I attended, in the wake of the Ivorian delegation, the seventh World Energy Conference held in Moscow in August 1968. The brilliant technological debate in which the qualified representatives of the great industrial powers engaged in that place left very limited room for the energy problems in the Third World. It is true that we had been granted, outside the official conference, the opportunity for about 30 auditors to meet in a small classroom of Mount Lenin University in Moscow. The talks were to come to an abrupt end, however, because we were not on the priority list of current concerns. And yet our needs were glaring; one-fourth of the world's population, that of the rich countries, shared three-fourths of our planet's energy resources. For example, electrical consumption per resident and per year was more than 1000 times greater in Norway than in the Ivory Coast, but that was too far outside the scope of the debates.

I had spoken in Budapest in 1971 following the U.S. delegate and I had noted, as I was to repeat in Detroit in 1974, that the problems of our companies, in developing tropical countries, are very far removed from the subjects debated in the industrialized countries composing UNIPEDE [Union of European Producers and Distributors], CIGRE [International Conference of Large Electrical Systems], the World Energy Conference, etc.

First of all, most of our installations are not as large as those of Western industrialized countries, which does not reduce the problems to be solved, however.

Considering the low consumption density of the areas served and the still very low purchasing power of the people and their specific needs, as well as our meagre financial possibilities, we must strive for minimum equipment and operating costs as much as possible. Accentuated by rapid growth in

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this initial stage, problems of financing are such, in our countries in which everything has priority, that we are not always in a position to adopt the most economical long-term solution.

Equipment is operated under extremely difficult conditions, due to the lack of skilled labor, the more than limited assistance of builders located far from our countries, the harshness of the climate and communications complicated by distances and by a lack of appropriate means.

The electrification of villages, which took place in Europe in an almost forgotten past age, is still totally lacking in our countries and its necessity is essential for our governments in order to curb a rural exodus, accelerated in our countries by the lack of industrial decentralization. Jobs in the secondary and tertiary sectors are also concentrated in our capitals, in which the population growth rate is such that it is difficult for the development of our urban systems to keep pace.

One of the main difficulties which we encounter in our development is the lack of skilled personnel. Although most of our companies have been practicing accelerated vocational training for many years, needs largely exceed available means. Technical and scientific orientation is not yet very widespread among our African youth, characterized from an early age by a traditional environment, unlike the young Westerner who comes into contact with technology from his birth and grows up in this environment. The rapid appearance of new technologies, due to the high growth rate of energy needs, thus requires frequent retraining and reeducation of our staff members.

The difficulties encountered at the level of workers and supervisors are just as acute in the training of young African engineers, currently provided in Western universities or schools because of a lack of local means. There are few candidates in comparison to the immense needs and the profuse training, if it is of a very high level, does not always result in immediate efficiency in tasks currently assigned to them when they become staff members of our companies.

This is why we organized technical day sessions in Abidjan in 1969, with the help of my French friends, and they had great response. This involved the meeting of officials of electricity companies and their engineers, our advisors, instructors and finally builders of electrical equipment for the production, transportation and distribution of electricity in our nations. This great meeting, which brought together English- and French-speaking African countries as well as high-level specialists, was to give rise to the idea of a technical union of the same nature, bound by formal ties and capable of facing, as a result of its seriousness and scope, all public hearings related to our activities.

On 21 May 1970, representatives of the electricity companies of 11 African nations met in Abidjan to establish this union and to stipulate as its purpose the study of technical, economic and social problems of the

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production, transportation and distribution of electrical energy, in order to promote an effective development of member countries in the interest of the peoples involved.

It was entitled the "Union of Producers, Transporters and Distributors of Electrical Energy of African Countries, Madagascar and Mauritius," or UPDEA. The Ivory Coast Electrical Energy Company was then put in charge of drafting proposed bylaws and internal regulations for the Union. I am especially happy to quote here the words of Minister Diawara: "I see in your Union a progressive instrument in the service of Africa, capable of making its own voice heard from now on in great international debates on questions of electrical energy."

Actually, I had to wait two more years in order to be able to realize this great hope of my African brothers, i.e., from the speaker's platform of the eighth World Energy Conference in Budapest. But I must also say that I never lacked encouragement and solid friendships down this long road. I am thinking particularly of the support and advice provided by the Union of European Producers and Distributors (UNIPEDE). Mr Decelle, the honorary president of this Union, also made it a point to attend the UPDEA congress held in May 1971 in Abidjan. And it is also in keeping with this line of thinking that we were able to be present, in September of the same year, at the 15th congress of that very important association.

As of today, the Union includes representatives of the electricity companies of the following countries: Congo, Ivory Coast, Cameroon, Benin, Central African Empire, Gabon, Ghana, Upper Volta, Mauritius, Liberia, Mali, Niger, Senegal, Chad, Togo, Zaire and Rwanda.

The Union includes active members, those of the aforementioned companies, but also affiliate members who, without being official operators of our industry, perform a job of technical and economic research and study for the benefit of the electrical energy industry in the respective countries. As nonrestrictive examples, I will mention: manufacturers of diesel engines, manufacturers of electrical cables, network builders, etc. In order to achieve its purpose UPDEA has: a supervisory board, a permanent general secretariat, study committees and finally, its congresses and its general assemblies. Union members meet in a congress every two years. Since the last congress in Dakar, they have met in a congress every three years and in a general assembly every year. The Union's official languages are French and English. The Union's headquarters are located in Abidjan. As of this year, Mr Issa Diop, general director of the Senegalese Electrical Energy Distribution Company, has taken over the UPDEA presidency and has thus replaced me in this position, which I have occupied since the establishment of our Union. There are currently five study committees; their number, authority and composition are decided by the supervisory board. In certain cases, the latter may call on specialists who may be selected from non-Union members. As of 1978, official agencies were represented by: a study committee for standardization and basic research, a study committee

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for inter-African cooperation, a study committee for rural electrification, a study committee for vocational training and finally, a study committee for bylaws and internal regulations.

It is not my intention to present here a detailed analysis of the work of each of these committees; however, I believe it is appropriate to give the reader a few general ideas of the most significant studies.

The study committee for inter-African cooperation is primarily devoted to analyzing the laws applying to each of the respective companies. It has subsequently given consideration to interconnection possibilities at the level of government and border regions. Placing itself on the human level, finally, it has recommended that Union members simultaneously pursue a policy of permanent contacts and bilingual training for managerial personnel.

The study committee for rural electrification has had a particularly delicate task. In fact, with the official purpose of describing the benefits contributed by electricity to all citizens of the same country, problems of priority, cost price, even equalization among the rate schedules of large conglomerates and those which can be applied to isolated rural areas necessarily and quickly arise. The Ivory Coast's experience has been applied in these areas.

My old friends know the enthusiasm with which I have always approached problems of vocational training, whether it is a question of the establishment of an electrical trades center for workers and supervisors or the training of engineers and administrative staffs in Western countries, particularly in France. That is, I have followed with very special attention the establishment of a group of experts assigned to help us develop a UPDEA project aimed at establishing a school for engineers in Africa. This question, of vital importance for our countries and now on the way to becoming a reality, is also the subject of a special report and I will leave it up to its authors to develop this matter.

Having said this, I could not silently overlook the important ties uniting UPDEA with many international organizations, notably UNIPEDE: it was in 1972 that a UNIPEDE-UPDEA coordinating committee was set up in order to avoid duplication in the store of knowledge and to promote its dissemination.

Our Union enjoys advisory status with the United Nations Educational, Scientific and Cultural Organization (UNESCO) as well as with the United Nations Industrial Development Organization (UNIDO). It maintains solid relations with the International Bank for Reconstruction and Development (IBRD), the African Development Bank (ADB) and the United Nations Economic Commission for Africa (ECA). For the purpose of widening its audience, it reports on the development of its activities with other government institutions, such as the Organization of African Unity (OAU), the West African Economic Community (CEAO), the Inter-African Commission on Hydraulic Studies (CIEH), the Senegal River Development Organization (OMVS), the Niger River

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Commission, the Maghrebian Electricity Commission (COMELEC), the Benin Electrical Community (CEB) and the Economic Community of Great Lake Countries (CEPGL).

The UPDEA is also in constant touch with the International Commission for Large Dams (CIGB), the International Conference of Large Electrical Systems (CIGRE), the Edison Electric Institute (EEI), the International Electrotechnical Commission (CEI), the International Atomic Energy Agency (IAEA) and finally, the World Energy Conference.

Similarly, the Union has maintained a continuous dialog with the British Electrical and Allied Manufacturers' Association (BEAMA) and the Trade Union Group of French Electrical Equipment Industries (GIMEE). The main purpose of such a dialog is the adaptation of equipment manufacturing to predominant operating conditions in Africa.

Since the establishment of UPDEA, six congresses and general assemblies have been held in the Ivory Coast (1970 and 1971), Mauritius (1972), Liberia (1973), Zaire (1976) and Senegal (1978). The supervisory board has met 11 times: in Liberia, Niger, Senegal, Madagascar, Zaire, Ivory Coast, Togo and Gabon.

As is apparent from this slightly tedious but necessary list, the UPDEA has now been accpeted by the highest international authorities concerned with our profession.

However, in conclusion, it must be pointed out that the UPDEA is not a political organization; it is essentially a union of engineers, technicians and managers searching together for the best ways to develop electrical energy on the African continent by reconciling the profitability requirements of our companies with the general interest requirements of our various countries.

Inter-African Electrical Staff School

Paris INDUSTRIES ET TRAVAUX D'OUTRE-MER in French Nov 78 pp 862-864

[Article by Bocary Sy, general secretary of the Union of Producers, Transporters and Distributors of Electrical Energy of African Countries, Madagascar and Mauritius (UPDEA), and R. Bouzonnet, expert with the Ivory Coast Electric Power Company (EECI)]

[Excerpt] The Union of Producers, Transporters and Distributors of Electrical Energy of African Countries, Madagascar and Mauritius (UPDEA) considers human training a priority among many problems. Significant efforts have already been made in Africa by companies producing and distributing electricity to train their workers and supervisory staff members. In many countries, all or almost all needs are being met by staff

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members who have received training in schools established in Africa, but the problem of management remains.

At the present time, young people who have chosen the profession of electrical engineer must take their higher studies abroad. Most of them are holders of scholarships granted either by governments or by electricity companies, but despite this, some of them no longer wish to return to their countries, preferring to seek work abroad for various reasons. Others are inclined to prolong their studies excessively and to prematurely take complementary higher instruction in economics, management, humanities, etc.

In addition, knowledge acquired in Europe or America is not always well suited or immediately useful to young engineers for the basic tasks which they will have to assume in their own countries.

This is why the UPDEA has decided to establish in Africa a school to train engineers for member companies, according to criteria more in keeping with their needs. Beginning in 1974, UPDEA's supervisory board therefore commissioned its permanent committee on vocational training to study the main lines of the project and to conduct a preliminary inquiry among member companies concerning their needs for engineers. In 1975, the UPDEA also asked the International Union of Electric Power Producers and Distributors (UNIPEDE) to appoint an expert mission to conduct a feasibility study on the school and to define the requirements for its completion.

After examining the reports of the experts and consulting all UPDEA members, the UPDEA's supervisory board decided the following:

The school will be established in the Ivory Coast, next to an electrical trades center near Abidjan; it will offer preparatory instruction (1 year) and the courses required for training electrical engineers (4 years).

Courses will be given in French or English equally.

Preparatory sections as well as sections of applied courses for graduate engineers may be opened in other Union countries. It was decided that a section of applied courses will be opened in Zaire, where specialized training in the area of hydroelectricity will be offered.

Other sections of applied courses may be opened later in various countries: application of nuclear engineering, data processing, solar energy, etc.

The school will be open not only to engineers of UPDEA member companies, but also, according to procedures to be defined, to future engineers intending to work in all occupational areas of electricity.

The school will keep possibilities open for providing continued training of working technical staff members and graduate engineers.

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Means Utilized for Project Implementation

At the suggestion of UNIPEDE experts and in order to successfully carry out the completion of its project, UPDEA set up a sponsorship committee composed of UPDEA members, representatives of major European schools or institutions and international universities and organizations (UNESCO, UNIPEDE). Mr Decelle, former UNIPEDE president, has been appointed chairman of this committee.

This committee plays an advisory role for the UPDEA's supervisory board and the team in charge of the project.

A work group derived from the sponsorship committee and particularly including professors from the Lausanne Federal Polytechnic School, the Paris Graduate School of Electricity and the Thames and Central London Polytechnic, has therefore been operating for several months in coordination with officials of the project team.

The sponsorship committee has therefore taken a very large part in working out instruction methods, the schedule of studies and programs, in defining technical and teaching equipment and in the design of the buildings. In addition, the sponsorship committee will provide assistance in recruiting and training teachers.

Project Consistency

Acceptance Capacity

The annual needs expressed by the member companies consulted by UPDEA for the 1978-1980 period vary from 44 to 68 engineers annually. It has been decided that longer-term studies in this area will be pursued in coordination with the educational systems in each respective country. But considering the rapid growth of electric power consumption in African countries, entailing a very considerable expansion of company staffs, it is conceivable that the number of engineers needed for future years, beginning in 1984 (probable date of the first graduating class), will be higher than that anticipated as of 1980.

Based on these considerations, the UPDEA has therefore decided to set the number of students in each graduating class at 48, with 60 students in the preparatory year. Since the length of studies is 5 years, including the preparatory year, the school will have to accept 252 students on a continuous basis. In addition, 32 places will be reserved for further training of experienced engineers. Thus the planned acceptance capacity will amount to 284 students.

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Description of Instruction

The general instruction offered at the school will be at a university level, as stipulated by the various UPDEA authorities, with studies being mainly oriented toward electrical engineering from the beginning. The school will also provide for all specialized and applied technical instruction. The school will be original in that it will train young engineers to be immediately "operational" within companies. The total course of theoretical and practical training will be officially recognized by an engineering degree issued by the school.

Engineers will have to be able to specialize and technically adapt in the following main areas:

Energy production: hydraulics; thermal (fuel oil, coal, nuclear); diesel and gas turbine; and to follow the development of all forms of new energy.

Electric power transportation: interconnection stations, distribution stations; transportation lines; power transmission.

Electric power distribution: high-voltage, medium-voltage and low-voltage distribution systems; supply of private residences; public distribution stations; subscriber distribution stations; industrial installations; subscriber installations.

Application and use of electricity: various electrical machines developing horsepower; lighting of buildings; thermal applications; refrigeration and cold production; air conditioning; electrochemistry.

Management: this training will be subject to very special attention.

Organization of Studies

Linguistic Training

In view of the bilingual character which the UPDEA wants to give to the instruction, it is essential that the student be able to take courses and express himself in French and English from the beginning of his schooling. Thus there is good reason to arrange beforehand, in the preparatory section, an intensive period of linguistic training for learning the language to which he is unaccustomed.

Course of Studies

The general 5-year plan of studies is summarized in the table on the preceding page. The year's work is arranged in three cycles, within which there are three vacation periods.

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Distribution of Cycles

Two study cycles will be held in the establishment, each lasting 17 weeks.

An 11-week work cycle will take place in a company, during which an engineering student will perform an actual job; at the end of the training period, he must write a report.

Teaching Methods

Instruction has been classified into groups:

Social sciences, so defined because by being concerned with everything regarding man in society in general and in the company's organization, they group together linguistic training, means of expression, economics, organization and humanities.

Mathematics, oriented according to their use in scientific and technical areas, represent the basic instruction of the engineer's first years of training.

The categories of "electricity" and "mechanics, thermodynamics and chemistry" (MTC) constitute the engineer's group of scientific disciplines.

Professional projects, whose purpose is to prepare the young staff member for industrial life, comprise three levels of concern:

1) An introduction to operations by way of performing practical projects, in the workshop or at the jobsite;

2) An introduction to supervisory operations, by way of exercises on organization, work preparation and taking charge of teams of workers, will enable the student to become aware of the difficulties encountered in this professional category, which is the natural midpoint between workers and management personnel;

3) A preparation for design engineer functions, covering the technical areas of electric power production, transportation and distribution companies and development engineer.

The general and scientific instruction will be administered as prescribed in the form of lecture-demonstrations provided to the entire class; supervised and professional practical projects will be carried out by small groups of 24, 16 or 8 students. Group projects will alone represent more than half of the time devoted to these disciplines.

The adjacent table shows the distribution of instruction.

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It is important to point out that professional projects represent 45 percent of the number of hours of instruction, with 50 weeks of training in the companies as well.

Project Implementation

Financing

Financing of investments, which will amount to approximately 3.5 billion CFA francs, will be provided by subsidies or long-term loans of international organizations or UPDEA members.

In addition, national or international cooperative organizations will make student fellowships available or will provide for the cost of certain teaching positions, in order to offset operating expenses.

School Term

The opening of the school is scheduled for 15 September 1979 for a preparatory year. Buildings will be completed in several stages and will be put into service in accordance with the school's needs, as the first class advances. Instruction in the same activity group will be administered in the same building: general instruction, mechanics, thermodynamics, chemistry; electricity, technical studies; etc.

The school will have a boarding system, with students being housed in rooms of four, two or one persons, depending on the year of their schooling. The school's students will enjoy the use of the group installations (swimming pool, all-sport stadium) of the neighboring trades center.

Operation of School

Instruction in each discipline will be provided by the major European schools or organizations which have concluded an agreement with the ESIAE [expansion unknown]: these are the Lausanne Federal Polytechnic School, the Paris Graduate School of Electricity, London Central Polytechnic and UNIPEDE. Under this agreement, the contributing organization will provide for the formulation of courses, choice of equipment for laboratories, the supervision and outfitting of the latter, the instruction and training of African teachers in this discipline and possibly the acceptance of graduate engineers for specialization.

The ESIAE is a specialized institution of the UPDEA; it will thus be administered by the UPDEA's supervisory board and a supervisory board which will be composed of UPDEA representatives, individuals selected for their competence in the area of electric power or scientific research and representatives of European schools and organizations which have signed instruction agreements with the ESIAE.

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The representatives of European schools and organizations will thus be able to rest assured that the objectives defined in the framework of the project are properly kept and will be able to take the required steps to achieve them.

The first class will graduate from the school in 5 years and at least 5 years will be needed to determine the value of the engineers trained and thus to establish the institution's reputation.

Thus this is a long-term task which has been undertaken, as always when it is a question of human training, as recalled by this old Chinese proverb: "Plant wheat if you are planning 1 year ahead, plant a tree if you are planning 10 years ahead, instruct the people if you are planning 100 years ahead."

Hydroelectricity in Africa

Paris INDUSTRIES ET TRAVAUX D'OUTRE-MER in French Nov 78 pp 814-817

[Article by Jacques Francou, assistant chief of the EDF [French Electric Power Company] Foreign Engineering Center (Department of Foreign Affairs and Cooperation)]

[Text] This vast subject, whose analysis would greatly exceed the scope of this article, has already been the subject of very interesting approaches in the special issue (December 1974) which this journal devoted to electricity in Africa. On the technical level, a more complete study should consider the character traits which give hydroelectricity in Africa a "pattern" of its own: demand is most often oriented toward "basic" energy, whereas "peak" sites are being sought more and more in highly industrialized countries; in addition, the geology, hydrological systems and available materials have a character that must be recognized and thoroughly studied. But it is especially at the level of worker skills that the context is fundamentally different from the European context. For example: labor--generally not very skilled--is abundant, whereas "managers" are extremely rare. The upshot of all this is that technologies, patiently developed under other skies, are not directly transferrable and can even lead to serious errors: the search for necessary--or economically attractive--adaptations will lead the planner toward an "African style" of hydroelectric development, which will become obvious and be confirmed as experience is acquired. This is a matter for specialists who will establish the project or take charge of its implementation once the decision to invest has been made. But what are the bases of a decision? What is the African

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"white coal"? And what economic advantage can the countries involved hope to derive? These are questions for which a synthetic essay, inevitably very imperfect, can provide some partial answers.

1. The African Hydraulic Potential

No complete inventory has been taken, but the economically obtainable African potential can be estimated at 1000 TWh [Terawatt-hour] in round numbers. This approximation is probably not too far off, since half of this potential is concentrated on the lower course of the Zaire River: 300 TWh for the Grand Inga project and 200 TWh for a development immediately upstream, with the remainder being obtained from the rapids after Kinshasa and Brazzaville. 1000 TWh is a considerable figure if we consider that 60 or 70 TWh are currently being obtained, already including several developments of respectable size.

This is also a considerable figure if we try to compare it to the hydroelectric possibilities of the entire world: they are even less well known than those of Africa, but it is believed that they could be on the order of 3000 to 4000 TWh for still unused and economically obtainable resources.

And yet the 1000 African TWh will be relatively insignificant in relation to the extreme energy-consuming hunger which has gripped the world: speaking only of electricity consumption, serious estimates place it at approximately 25,000 TWh by the year 2000.

African hydraulics thus contribute approximately 4 percent to world electricity production, an initially disappointing proportion, but which has as its corollary the conviction that these resources should be utilized within the near future.

This is in an "ideal" world, it is true, unfortunately more hypothetical than obtaining 1000 TWh in Africa. . . .

Still, in the world such as it is, the development of this storehouse of energy is currently making vigorous strides, which will probably continue to accelerate.

2. Distribution of Resources

One part of the African continent is composed of deserts; another part is faced with the distressing problem of water resources which are inadequate for satisfying essential needs and hydroelectricity will find no application there.

If resources are thus distributed very unequally, they nevertheless enjoy an important geographic advantage: most high-output and worthwhile sites are located a short distance from the coast: Konkoure, Sassandra,

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Akosombo, Sanaga, Ogooue, Kouilou and Inga, just to mention a few examples. This energy can be transmitted at relatively low expense to the vicinity of a port and can be considered "exportable."

3. Energy-Need, Energy-Resource

Certain African nations must therefore consume oil in order to meet their needs; others will find an important contribution to these needs in hydroelectricity; finally, others possess a very abundant store, which may become one of the driving forces of their economies: this is what we will call the energy-resource.

The table at the end of this article is compiled on the basis of world statistics and classifies the various countries in decreasing order of their electrical consumption in relation to their gross national product [GNP].

These statistics have several gaps and the figures, difficult to compile, are provided without any guarantee of their accuracy: sometimes they vary appreciably from one source of information to another and undeserved accuracy must not be attributed to the values listed, rather the entire list must be considered more qualitatively as furnishing orders of magnitude.

The countries have been arranged in four groups: more than 300 kWh [kilowatt-hour] per F 1000 GNP; between 300 and 150 kWh; between 150 and 75 kWh; and less than 75 kWh per F 1000 GNP.

An initial observation demands recognition: there is no correlation (in the arithmetic sense of the term) between a country's economic level and its electrical consumption. Saudi Arabia and Norway, with comparable economic levels, consume 10 kWh per F 1000 on one hand and more than 500 kWh on the other, and the reasons for this are obvious. It may also be noted that France, among highly industrialized nations, turns out to be particularly thrifty with electric power: in this matter each political entity has its own orientation.

If electricity consumption cannot therefore be considered a barometer of prosperity, it is nevertheless apparent that developed countries utilize their hydroelectric possibilities until their energy needs are satisfied or until national resources are exhausted.

Developing countries are at the dawn of utilizing this natural wealth and it is interesting to note the place of African nations in the classification shown: rare at the top of the table, they are the majority in the last group.

It is obvious that Zambia and Rhodesia owe their position in the first group to the recent completion of a single sizable hydraulic development; and if Zaire were to have access tomorrow to the energy from the Inga 2 development (9.6 TWh), it would move to the head of the group.

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Not surprisingly, among the countries with very low consumptions are: Chad, Upper Volta, Mauritania and Libya; but also countries considerably better endowed by nature: Madagascar, Congo and Guinea, in which connection it may be wondered if they are not thus neglecting an important privilege.

4. Cost of Developments

If we divide the cost of a development by its annual potential productivity, we obtain a "per kWh-year" price, the most immediate criterion of the intrinsic value of the sites, at least insofar as the production of "basic" energy is concerned.

This criterion can vary broadly between F 0.20 and F 2.60 (1978 FF), the range within which it is situated.

It is also a current practice to compare the hydraulic development with an equivalent thermal plant: the comparison shows (with very rare exceptions) a higher investment in the hydraulic development than in the thermal plant.

If we divide this higher investment by the annual fuel savings, we obtain an approximate picture of the development's rate of profitability, which only a complete economic study can furnish with accuracy.

The approximate picture is sufficient to compare various hydraulic developments and this is the purpose of the table at the end of this article.

In the first part of the table, about 15 French river developments (Rhine and Rhone) have been considered, whose respective costs have been "updated" as of 1 January 1978. If they had not already been completed, these developments would no doubt still be planned (even concurrently with nuclear developments) and thus they represent a valid European reference. A slight variation in the figures may be noted, with averages being established at F 1.20 for the "kWh-year" and at 12 percent for the approximate rate of profitability.

Some African developments which have been planned, are underway or recently put into service, have been classified in the second part of the table. The reader will probably regret not seeing some important developments there (Kariba, Saad el Aali, Akosombo, Kafue, Cabora-Bassa), whose economic data we were unable to find.

Even incomplete, the classification is particularly significant: exceeding or nearly exceeding the European reference are developments with generous hydrology and falling below this same reference are developments with meagre hydrology. This is basically only a numerical expression of a truth of La Palice: hydroelectricity is, above all, a question of FLOW. (The figures regarding the equivalent thermal plant and fuel savings are those of the article by Mr Roger Millot and Mr Jacques Apertet in this journal.)

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Finally, the third part concerns development-resources, i.e., those whose capacities exceed the medium-term needs of their immediate environment and which are justified only by exportation or the simultaneous establishment of a consumer industry, whether domestic or foreign.

In this case, there is no longer any equivalent thermal plant, since the hydraulic development does not meet a need; and it may be considered that the savings is of "ex Europe" fuel, whose price is generally much less than that of "ex Africa" fuel.

To the extent that these simplifying hypotheses are accepted, the energy-resource is thus heavily penalized in relation to the energy-need and will remain the attribute of very high-value sites.

Experience proves that such sites actually exist in Africa and we have listed the figures for the Grand Inga project next to Inga 2 and Song-Loulou: although completion cannot be considered imminent, we could not speak of an energy-resource without mentioning this exceptional potential.

It is possible to install at Inga, in a single plant, 40,000 MW [expansion unknown], which would produce 300 TWh annually, absolutely guaranteed. Implementation is anticipated in a gradual fashion, in 13 identical installments, each producing 23 TWh. In oil savings, figured at 9.7 centimes (1978) per kWh, the first installment would be paid off in 4.5 years, whereas each of the following 12 installments would pay for itself again every 10 months! . . .

5. High-Voltage Power Transmission--Energy Carriers

One of the recognized advantages of electric power is in the apparent ease with which it can be transmitted; and actually, in European countries where networks are very dense and distances short, this appearance is not misleading.

But the case is completely different when lines have more modest capacities and especially when distances are on the African scale. . . .

If we wish to go from the site of production to a distant point of consumption (let us say 1000 kilometers) without making it necessary to provide intermediate breaking stations, the technical and economic solution consists of rectifying the current in order to transmit it "continuously."

It is still necessary to make sure that the final result [hydraulic installation + conversion stations + line] remains favorable. In such a representative case, the economic studies on the installation and line should be conducted at the same time and, in order to avoid any surprise, the respective business transactions should also be concluded at the same time.

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The final result may reveal that the cost of the line is by far the largest, which leads to the conclusion--in the African context and contrary to accepted ideas--that electricity is poorly transmitted: in any case it cannot be exported in this form to other continents, which leads to a consideration of using other energy carriers.

Uranium enrichment by gas diffusion would probably be the ideal carrier: this technique, which consumes a great amount of electricity, has been perfected; but the problems posed are of a nature other than technical.

Electrolytic hydrogen could be another possibility, currently the subject of numerous studies. But the manner of consideration differs notably from one continent to the other.

Europe, which could use and transport hydrogen in the gaseous state, has available only expensive kWh and questions of yield are therefore of prime importance.

Africa, in the vicinity of the most attractive hydraulic sites, could produce "exportable" hydrogen beginning today; but how would it be transported? Liquid hydrogen? Hydrides? The question remains open.

Without ruling out any solution, it is obvious that the most elegant one would be to undertake a redistribution of the cards internationally, which would lead to the establishment of large energy-consuming industries in the immediate vicinity of the best energy sources.. . . and Africa would then receive excellent cards in the game.

6. The "Small Hydraulic" Installation

We have seen that the most economical and most powerful sites are fortunately located within a relatively short distance from the coastline (energy-resource), but also that transmission of this energy to the interior is very expensive.

Moreover, it is generally agreed that the interior of the vast continent has attractive and sizable sites, the most obvious of which are already being developed (energy-need). But still because of the cost of transmission, their "effective radius" will be all the more limited as their intrinsic value is less exceptional.

Does this mean that the rest of the continent is doomed to burn diesel oil in order to satisfy a generally modest and very scattered demand? Nothing is less certain and small hydraulic installations (from 100 kW to 1 or 2 MW) should provide an attractive solution when water resources are adequate.

A paradoxical and almost vexing observation may actually be made: in France (where penetration of the EDF system is complete), about a thousand hydraulic installations of less than 1 MW are operating to the satisfaction of their users, who would otherwise abandon them in favor of the EDF

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supply; in Africa--where thermal energy is still much more expensive--small hydraulic installations are extremely rare.

This gap, surprising at first, has its reasons:

In France, because of the predominance of thermal power and thanks to a very complete transmission system, hydraulic energy is always "marketable" and adapting to the irregularity of hydrological systems is easy. In Africa, on the contrary, where guaranteed energy is sought, it must be possible to have available a constant flow of water or to provide an associated thermal installation.

Economically, the studies to be conducted for prospecting a site and setting up a project are not proportional to the power of the development: in the case of small installations, their expense may become prohibitive.

It is not less a fact that the small hydraulic installation is currently experiencing a very justified renewal of interest and that it may likely offer attractive solutions in Africa: in this journal, M. P. Genin's article discusses some of them.

But the path is completely virgin and Africa is huge. . . . Site-by-site prospecting is out of the question. The problem deserves--in my opinion--to be approached by an "in abstracto" study as complete as possible before embarking on practical solutions.

7. Importance of Hydrological Measurements

We had the opportunity to observe earlier that the value of a development (small or large) was directly related to the flow of the river or stream in question. This is an obvious fact, but who is clearly aware of it?

It happens very often that once the structure has been put into operation, the hydrology turns out to be different from the "planned" hydrology. The planner, who can do nothing about this, will too readily be held responsible, since surprises in this case are always bad surprises: if there is less water than anticipated, the operation's economic outcome may be jeopardized; on the other hand, if there is more, there will be regrets over underdevelopment and of thus losing particularly attractive marginal production.

There may be even more serious fears: insufficient dimensioning of the spillway gate, which is often a difficult and always expensive structure. For example, the Kariba site was faced with the "millenial" flood beginning the first year, and the "deca-millenial" flood the second year . . . which means, to put it more simply, that the hydrology of the Zambezi was definitely not well known at the time. It was necessary to repair the damage, go over calculations, plans and specifications in the middle of a disaster and redimension the gate on a larger scale. All this is now just an

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anecdotal memory, but what would it have been if the "deca-millenial" flood had not occurred until 4 years later, after the dam was completed and filled? . . .

Better knowledge of hydrological systems is basic for productive water use, an essential resource of a nation; and data collection is a long-term project to which all of its deserved importance is rarely granted: this requires a responsible person in charge, a little attention, much knowledge and even much more perseverance, but very little money.

8. Transfer of Technical Capital

Historically, hydraulic energy is the only technology to have widely preceded industrial civilization; it mainly requires intuitive but practical concepts: pressures, heights, flows, all visible quantities whose meaning is immediate. From this standpoint, it is the opposite of classical thermal energy, which is accessible only at the price of high-performance equipment, the result of all types of studies which are far from being intuitive.

The transitional process leading to nuclear thermal energy is even more accentuated: the phenomena which make it possible to harness nuclear energy can be discovered, understood and assimilated only as a result of long and difficult studies and the reactor itself is filled with sophisticated equipment measuring quantities which are very mysterious at first sight.

Thus besides purely economic aspects, hydraulic energy is the only type (along with the windmill . . .) to hold the notable trump card of simplicity. Thus--and this is even truer of the "small-hydraulic installation"--it offers to international cooperation one of the surest ways of tackling its main problem: the transfer of technical capital from industrialized nations to developing nations.

Yes: hydroelectricity is an excellent card in the game of Africa.

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Electric Power

1976 World Statistics

1. Population in millions
2. Gross National Product in billions of francs
3. Electric power in TWh
4. Quotient: kWh per F 1000 GNP

	1	2	3	4
Surinam	0.4	2.6	1.0	615
*Zambia	5.0	11.5	7.0	609
*South Africa	25.4	150.0	78.0	520
Norway	4.0	146.0	75.0	514
Iceland	0.2	5.3	2.3	433
Romania	21.0	124.0	53.0	427
Bulgaria	8.7	78.0	29.0	372
*Rhodesia	6.0	16.2	6.0	370
New Zealand	3.0	58.0	21.0	362
USSR	256.0	2970.0	1050.0	353
Luxembourg	0.35	10.0	3.4	340
Yugoslavia	21.0	135.0	43.0	318
Canada	23.0	911.0	283.0	311
Albania	2.5	6.7	1.8	267
South Korea	34.6	90.0	24.0	267
United States	215.0	8100.0	2116.0	261
Chile	10.4	36.4	9.4	258
GDR	16.8	314.0	79.0	252
Sweden	8.0	344.0	86.0	250
United Kingdom	56.0	1036.0	256.0	247
Czechoslovakia	14.8	241.0	59.0	245
Finland	4.7	133.0	32.0	240
Colombia	23.5	61.0	14.0	230
*Zaire	25.0	17.0	3.8	225
Poland	34.0	442.0	96.0	217
Hungary	10.6	115.0	24.0	209
Ireland	3.1	37.0	7.7	208
Italy	56.0	784.0	154.0	196
Costa Rica	2.0	8.4	1.6	190
*Egypt	38.0	53.0	10.0	189
Pakistan	70.0	47.0	8.8	187
India	610.0	427.0	80.0	187
Argentina	25.7	164.0	30.0	183
Japan	112.0	2655.0	483.0	182
*Ghana	10.3	22.0	4.0	182
*Cameroon	5.8	7.5	1.4	180
China	839.0	1310.0	230.0	176

[table continued on following page]

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Electric Power, continued

	1	2	3	4
Israel	3.4	57.0	10.0	175
Malaysia	12.3	39.0	6.5	167
Spain	36.0	500.0	83.0	166
Austria	7.5	192.0	31.0	161
Brazil	109.0	501.0	78.0	156
Portugal	8.8	70.0	10.8	154
Greece	9.0	105.0	16.0	152
Thailand	43.0	64.5	9.8	152
Australia	13.5	450.0	68.0	151
Uruguay	3.0	17.3	2.6	150
Venezuela	12.3	144.0	21.0	146
FRG	61.5	2146.0	312.0	145
Peru	16.0	58.0	8.3	143
Philippines	43.8	74.0	10.4	140
Mexico	62.3	349.0	46.0	131
Netherlands	13.8	421.0	55.0	131
Belgium	9.8	321.0	41.0	128
Bolivia	5.8	8.0	1.0	125
Switzerland	6.4	275.0	33.0	120
France	53.0	1675.0	196.0	117
*Mauritius	0.9	2.4	0.27	112
Denmark	5.0	179.0	20.0	112
Honduras	3.0	4.5	0.5	111
Turkey	40.0	188.0	18.0	96
*Ivory Coast	4.9	12.0	1.11	93
*Morocco	17.8	37.0	3.0	81
*Benin	3.2	2.0	0.16	80
*Senegal	4.0	6.4	0.48	75
*Tunisia	6.0	20.0	1.5	75
Syria	7.6	22.0	1.6	73
Iran	33.0	218.0	15.7	72
*Kenya	13.8	13.8	1.0	72
Afghanistan	19.3	11.2	0.8	71
Ecuador	6.7	20.0	1.3	65
*Algeria	17.3	60.5	3.7	61
Guatemala	6.2	18.0	1.0	56
*Uganda	11.5	13.0	0.7	54
*Gabon	0.5	6.0	0.32	53
Burma	31.0	15.0	0.8	53
*Ethiopia	28.0	12.0	0.6	50
Iraq	11.0	69.0	3.4	49
Bangladesh	76.0	36.0	1.4	39
*Madagascar	8.0	6.4	0.24	37
*Mali	5.7	2.3	0.08	35

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Electric Power, continued

	1	2	3	4
*Nigeria	63.0	88.0	3.2	36
*Congo	1.4	3.0	0.1	33
*Central African Empire	1.7	1.7	0.05	30
Indonesia	136.0	116.0	3.4	29
*Niger	4.7	2.8	0.08	29
*Chad	4.0	2.0	0.05	25
*Upper Volta	6.0	2.4	0.06	25
*Mauritania	1.3	1.7	0.04	24
*Guinea	4.4	26.0	0.5	19
*Libya	2.4	55.0	0.9	16
Saudi Arabia	9.0	200.0	2.0	10

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Hydroelectricity in Africa
Approximate Cost and Economic Results of Some Developments
(Unit: French francs as of 1 January 1978)

EUROPEAN REFERENCE		Hydraulic Installation		Equivalent Thermal Installation			E-T Difference	Fuel Savings		E/M-T
		Energy (GWh-yr)	Cost: H (10^6 F)	Power (MW)	Annually (F/kW)	Cost:T (10^6 F)	(10^6 F)	Annually (centimes)	E (10^6F)	%
OTTMARSHEIM	Rhine	980	961	196	1910	375	586	9.7	95	16%
CHATEAUNEUF	Rhone	1,640	1,613	328	"	627	986	"	159	16%
FESSENHEIM	Rhine	1,020	1,046	204	"	390	656	"	99	15%
RHINAU	Rhine	946	1,025	189	"	361	664	"	92	14%
VOGELGRUN	Rhine	820	893	164	"	313	580	"	80	14%
BEAUCHASTEL	Rhone	1,210	1,352	242	"	462	890	"	117	13%
LOGIS-NEUF	Rhone	1,190	1,395	238	"	455	940	"	115	12%
GERVANS	Rhone	700	845	140	"	268	577	"	68	12%
BOURG-LES-VALENCE	Rhone	1,100	1,373	220	"	420	953	"	107	11%
GERSTHEIM	Rhine	768	969	154	"	294	675	"	74.5	11%
MARKOLSHEIM	Rhine	928	1,200	186	"	355	945	"	90	11%
KEMBS	Rhine	918	1,188	184	"	351	837	"	89	11%
CADEROUSSE	Rhone	860	1,134	172	"	329	805	"	83	10%
AVIGNON	Rhone	940	1,264	188	"	359	905	"	91	10%
BEAUCAIRE	Rhone	1,300	1,853	260	"	497	1,356	"	126	9%
Total (Reference)		15,320	18,111			5856	12,255		1486	12%
AFRICA: Energy Need										
INGA 1	Zaire	2,400	1,242	480	2090	1003	239	11.04	265	111%
SOUBRE	Ivory Coast	1,490	894	298	2180	650	244	11.04	165	68%
RIVIERE DE L'EST	Reunion	380	251	76	2270	173	78	12.55	48	62%
BUYO	Ivory Coast	840	758	168	2800	470	288	12.80	108	38%
TAABO	Ivory Coast	850	877	170	2800	476	401	12.80	109	27%
GRAND POUBARA	Gabon	1,900	1,853	380	2090	794	1,059	11.04	210	20%
PETIT POUBARA	Gabon	115	153	23	3100	71	82	13.40	15.5	19%

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Hydroelectricity in Africa, continued

	Hydraulic Installation		Equivalent Thermal Installation			H-T Difference	Fuel Savings		E/H-T
	Energy (GWh-yr)	Cost: H (10^6 F)	Power (MW)	Annually (F/kW)	Cost:T (10^6 F)	(10^6 F)	Annually (centimes)	E (10^6 F)	%
AFRICA: Energy Need (continued)									
TCHIMBELE Gabon	305	452	61	2400	146	306	13.15	40	13%
NOUMBIEL Upper Volta	300	720	60	2400	144	576	17	51	9%
SELINGUE Mali	200	525	40	2600	104	421	17	34	8%
AFRICA: Energy Resource									
GRAND INGA (installments 2 to 13)	23,000	1,875	4600		0	1,875	9.7	2231	120%
INGA 2	9,600	2,070	1920		0	2,070	"	931	45%
SONG-LOULOU Cameroon	2,800	950	190		0	950	"	272	29%
GRAND INGA (1st installment)	23,000	10,150	4600		0	10,150	"	2231	22%

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Aid to French-Speaking Countries

Paris INDUSTRIES ET TRAVAUX D'OUTRE-MER in French Nov 78 pp 881-883

[Article by Antoine Le Clerc, assistant director of the Central Fund for Economic Cooperation]

[Text] At the end of World War II, France decided to implement an active policy of social and economic development in sub-Saharan African countries. This policy was based on the law of 30 April 1946, which provided for the establishment of specific structures for financing development investments. Thus the Investment Fund for Economic and Social Development (FIDES) was established, which was followed by the Aid and Cooperation Fund (FAC) and the Central Fund for Economic Cooperation (CCCE).

The pursuit of this policy entailed a special effort in the area of electric power. The availability of electrical resources in sufficient quantities and at reasonable prices is actually one of the conditions for economic development. In the years following the war, the available electric power of countries was low. Only a few large cities enjoyed public distribution. There was practically no distribution in minor cities and this was even truer in rural communities.

France's effort in promoting the development of electricity took the form of projects which introduced: the EDF in the technical area; FIDES and then FAC in the area of financing, by means of subsidies and loans with special conditions; and the Central Fund for Economic Cooperation and the French banking system in the area of financing, by means of loans.

Also added to this effort was that of already established private companies: West African Water and Electricity Company in Dakar and the Electric Power and Water Company of Madagascar, for example.

The effort undertaken by French public authorities involved the establishment of institutions needed for the development of electricity, the financing of studies and investments and the financing of technical assistance in the operation of companies. The results obtained were significant. For example, Table 1 provides a general view of the growth of energy production in a certain number of centers during the last 20 years (in GWh).

For a better idea of the size of these companies, some characteristic data (Table 2) for some of them is provided (as of 31 December 1976, except for other indications listed in parentheses).

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Table 1.

	1955	1960	1965	1970	1976
Abidjan, interconnected system		70	200	440	908
Dakar and interconnected centers	72	145	232	330	469
Edea (Cameroon), Douala-Edea-Yaounde interconnected system	4.9	897*	1065	1108	1241
Libreville	---	5	19	47	250
N'Djamena	---	7.7	18	30	39
Niamey	1.7	6	15	33	52
Ouagadougou	0.6	5	14	18	31

* The high increase noted is explained by the fact that the Alucam plant was put into operation.

Table 2.

	Installed Power (MW)	Energy Emitted (GWh)	Subscribers	Turnover*
Ivory Coast	512	1115	166,300	20,900
Upper Volta	20.080	59	11,705	2,204
Mali	40.305	80	25,725	4,890
Niger	22.104	77	16,624	2,941**
Senegal	138	469	136,587	9,157
Togo	13.700 (77)	116 (77)	18,303 (77)	2,000 (77)
Cameroon (June 1977)	380	1320	78,837	11,784
Congo	42.500	113	23,256	3,190
Gabon	205 (77)	328	27,115 (77)	9,100 (77)
Chad	21.4	55	5,614	2,066**

* In millions of CFA francs; the CFA franc is worth 0.20 FF and 0.00 $U.S. Except for Mali, in millions of Malian francs; the Malian franc is worth 0.10 FF and 0.002 $U.S.

** Electricity turnover only.

I. Establishment of Institutions Necessary for Development of Electricity

Before examining the various aspects of French financial aid, it is useful to briefly recall the conditions under which organizations in charge of producing and distributing electricity were established and developed.

In the years immediately following the war, there were only a few electrical distribution companies in Africa, mainly in the large coastal cities.

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In their absence, the production and distribution of electricity were provided by the government.

The effort undertaken by French public authorities was primarily intended to establish electricity companies where there were none. These companies were established on the model of semi-public corporations. They had territorial authority or federal authority when the establishment of a territorial structure was not warranted. Thus for example, the Ivory Coast Electric Power Company, the Guinea Electricl Power Company, the Electric Power Company of AEF [French Equatorial Africa] and the Electric Power Company of AOF [French West Africa] were established, just to mention a few. The structures of these companies had been designed to bring together all parties concerned with the development of electric power:

Users first of all, mainly local interests: the Federation of the AOF or AEF, territories, communities and private stockholders;

A technical organization: the French Electric Power Company;

Financial organizations: FIDES and the Central Fund for Economic Cooperation.

The independence of the countries was accompanied by a dual development. On one hand, federal companies gave way to national companies. Thus beginning with SAFELEC [expansion unknown], the Mauritanian Electricity Company, the Electric Power Company of Mali, VOLTELEC [Voltan Electric Power Company] and NIGELEC [Niger Electric Power Company] were established. Similarly, the Electric Power Company of AEF was replaced by the Chadian Electric Power Company, the Central African Electric Power Company and the National Electric Company of the Congo.

On the other hand, there was a gradual nationalization of these companies, with the government alone, or almost alone, taking control of them. This policy was a result of the governments' concern to entrust this important sector of the economy to national officials. This was done in various ways, either by repurchasing the stock held by the non-national public stockholders EDF-FAC and the Central Fund for Economic Cooperation, or by recovering concessions, after negotiations, in the case of private companies.

The financial effort undertaken by French public authorities to help establish these companies was significant. Thus the investments made in these companies by FAC (or FIDES) and the Central Fund for Economic Cooperation may be estimated as follows:

With regard to FIDES, about F 20,300 from its origin until 1960, when FAC was established.

With regard to FAC, F 1.25 million since the establishment of this fund in 1960 to 31 December 1977.

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With regard to the CCCE, about F 40.277 million of its own funds from its origin to 31 December 1977.

The amount of these investments may appear rather modest. However, it should not be forgotten that they were chiefly made in the first years of operation of these companies, at a time when the value of the franc was higher.

II. Financial Aid

French aid in this area has had two main orientations: the financing of studies and the financing of investments.

Financing of Studies

This action is fundamental. It determines the development of electricity in a nation by making it possible to develop investment projects. The financing provided involved investment studies and general studies.

As their name indicates, investment studies are intended to develop investment projects. They may even include opening a file for a call for bids. Aid to finance these studies takes on even greater importance as projects, especially in the production sector, become larger and the corresponding studies become more expensive. The development of hydroelectric energy, with the very high investments required, explains this trend, among others.

In the area of hydroelectricity, research studies on sites have made it possible for companies to acquire inventories of their potential resources. In addition to investment studies, we must also mention the financing of general studies, which enable a producer of electricity to orient his policy. These consist of studies on consumption, business transactions, rate scheduling and investment programs. The importance of these studies must not be underestimated. They determine the validity of policies followed by companies.

Considering their indirectly profitable nature, these studies were most often financed by FIDES or FAC, for lack of financing by companies and the Central Fund for Economic Cooperation, a lending organization which was practically not involved in this area. As of 31 December 1975, financing granted since 1960 by FAC amounted to F 4.80 million for general studies and to F 11.40 million for project studies. It would also be appropriate to add to these figures the subsidies, endowments and advances granted by FIDES, which have amounted to approximately F 57 million.

Financing of Investments

1) This is quite obviously the area in which French financial aid has played the most important role. In this regard, it may be observed that until recently foreign financing of electricity companies was almost

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exclusively provided by French resources alone. This aid was mainly in the form of loans from the Central Fund for Economic Cooperation. In fact, to the extent that investments in the electricity sector are profitable, it seems justified to allocate reimbursable resources for their financing.

In addition to loans from the Central Fund for Economic Cooperation, however, in certain cases there were also subsidies from FIDES or advances with favorable conditions from FAC, when a project's more remote profitability involved a reduction of financing charges. Thus the first hydroelectric projects of Djoue in the Congo, Edea in Cameroon and Great Falls in Guinea were originally financed by FIDES and the Central Fund for Economic Cooperation. Even more recently, FAC and the Central Fund jointly participated in financing the first installments of the Vridi thermal power station in the Ivory Coast and in financing the Selingue Dam in Mali.

In addition to this financing by FAC and the Central Fund, for several years there have also been private credits guaranteed by COFACE [expansion unknown] in the form of purchaser or supplier credits. The provision of guarantees by COFACE is decided in cooperation with FAC and the Central Fund in order to assure consistent financing granted to electricity companies. In addition, French aid very often takes the form of joint financing--purchaser or supplier credits and credits from the Central Fund or FAC.

The increase in the cost investment has made this type of financing very frequent, since the Central Fund and FAC alone could not provide financing of larger and larger investments.

Joint financing operations with bilateral or multilateral aid organizations have also multiplied recently for this reason. Thus French financing has been combined with that of organizations such as the European Investment Bank [EIB], the World Bank, the African Development Bank, the KFW [Reconstruction Credit Bank] and Arab Funds.

For example, it was under these conditions that the largest hydroelectric installations were financed in recent years: Selingue in Mali, Song-Loulou in Cameroon, Taabo in the Ivory Coast, Sonichar in Niger. On the other hand, the M'Bei developments in Gabon and the Buyo hydroelectric plant were almost entirely financed by resources of French origin, in addition to local resources.

In joint financing operations, the Central Fund tries to facilitate the provision of various types of financing every time that this becomes necessary. Several operations were thus able to be set up as a result of its intervention. Thus in the case of the financing for the Song-Loulou dam, at the request of the Cameroonian Government the Central Fund served as liaison for a certain number of financial organizations such as the EIB and Arab Funds. Thus it facilitated the establishment of a round-table conference which made it possible to provide financing for that installation, estimated at more than 50 billion CFA francs.

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We would have a false picture of the financing set up in the electricity sector, however, if we did not point out that electricity production companies have participated in financing their own sizable investments by way of self-financing. In its capacity as administrator of these companies, the Central Fund has always endeavored to promote a management policy which would make it possible to obtain this type of funds. In particular, the Central Fund gives special attention to problems of pricing and management of the "client" portfolio, which determined the company's capacity to finance a significant portion of its investments. In this connection, we must bear in mind the difficult nature of the financial problems which these companies will have to face. The very rapid growth rate of consumption forces them to make larger and larger investments. Frequent recourse to hydraulic energy involves very high interest costs at the same time. Their financial needs are thus increasing at an extremely fast rate. Only strict financial management, combined with significant foreign aid, will make it possible for companies to meet their obligations in the future.

2) Over the years, the orientation of French financial aid has undergone changes which are interesting to recall here.

Apart from the few hydroelectric installations of Djoue, Edea, Great Falls, Sotuba in Mali and Ayame in the Ivory Coast, the French financial effort originally involved thermal installations more particularly and notably diesel installations. It seemed at that time that hydroelectric installations offered production capacities which were too large in relation to existing local needs and did not make it possible to produce a cheap kWh. The installation of diesel plants was more advantageous at that time and provided greater flexibility of use for their owners. With the oil crisis and the rapid development of consumption, the use of hydraulic energy became very attractive to the nations. This is why French aid is now striving to facilitate financing of these installations. In keeping with the development of this type of investment, the Central Fund is endeavoring to promote the interconnection of nations and, within the same nation, the development of transmission systems in order to connect smaller communities to the largest power stations. This corresponds to the concern of providing the greatest possible use of hydroelectric installations, which are costly investments, and making it possible to shut down small thermal power plants whose operating costs have become too high for the clientele served, mainly because of the price of petroleum products.

Besides traditional means of production, French aid is also concerned with the development of new types of energy, such as solar and wind energy. Applying the experience acquired in using solar pumps, largely financed by the FAC, the Senegal electricity company will experimentally undertake the installation of solar electric power plants for supplying small rural centers. That is an experiment which may be very interesting and in order to facilitate this experiment, the Central Fund is offering to finance the installation of an initial plant in Diakhao.

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3) The figures listed below will provide an idea of the amount of financing granted by the various French sources. The sums granted by the FAC, since its establishement to 31 December 1975, for financing installations of electricity companies, amount to nearly F 86 million. Loans granted by the Central Fund from 1950 to 31 December 1977 in turn amount to approximately F 1.657 million, distributed as follows: Benin, 1; Cameroon, 407; Comoro Islands, 13; Congo, 48; Ivory Coast, 386; Djibouti, 56; ECA [Central African Empire], 13; Gabon, 293, Guinea, 2; Upper Volta, 36; Madagascar, 59; Mali, 68; Mauritius, 52; Mauritania, 20; Niger, 90; Senegal, 99; Chad, 6 and Togo, 8.

Here again, it must not be forgotten that many advances were granted at times when the value of tne franc was not what it is today. As for purchaser or supplier credits granted with the guarantee of COFACE, in this regard it will be noted that the proportion of financing by commercial credits guaranteed against the repatriable portions of the contracts concluded and confirmed to COFACE in 1976-1977 and the first quarter of 1978, in the area of electrical installations, amounted to approximately F 652 million, distributed as follows: Cameroon, 172; Ivory Coast, 176; Gabon, 126; Upper Volta, 10; Niger, 114; Mali, 13; Mauritius, 16; Togo, 22; Mauritania, 2 and Congo, 1.

This description would not be complete if we did not recall that private electricity companies, particularly the EEOA [expansion unknown] and EEM [Electric Power and Water Company of Madagascar], have also taken an active part in financing investments in this sector of economic activity.

III. Technical Assistance to Companies

French financial aid is not limited to financing projects or studies. It is also concerned with providing to companies the assistance which they consider necessary for managing their affairs.

This aid takes the form of financing for technical assistance personnel and training programs. It actually appears that financing such operations, which make it possible to improve the management of companies, would be, in a sense, as important as financing investments themselves.

1) Technical assistance includes making skilled personnel available to companies. Such personnel is chiefly lent by the EDF. To date, the number of these staff members may be estimated at nearly 400 for French-speaking Africa. Mr Pecoux's article on the EDF program, also published in this issue, provides detailed information on this subject. Financing for these staff members is provided by the companies themselves or by FAC. Amounts thus allocated by this fund in 1978 may be estimated at F 7.60 million.

2) Training aid is also technically provided by the EDF. The latter makes competent personnel available to companies for the establishment and

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operation of vocational training centers. These centers play a very important role in the training of skilled technical personnel. Practically all companies have such centers today. The necessary financing has been provided by the companies or by FAC.

A dual development is taking shape in this area. On one hand, training programs are no longer limited to just technical training. They tend to encompass all aspects of a company's life and particularly administrative and financial aspects. An effort, particularly in the area of management, will be undertaken jointly by the EDF and the Central Fund. The very rapid growth of companies actually poses more and more complex management problems for their boards of directors.

On the other hand, the Central Fund has also decided to take part in financing training programs when these programs are directly related to job preparation. It may probably seem unusual that a lending organization would become involved in this area, which seems to be the domain of subsidies. However, it seemed that to the extent that the programs thus financed made possible the training of skilled administrative and technical personnel, it was the investment's profitability which was thus reinforced. Programs of this type, financed by the Central Fund, are still few in number. The total amount of credits granted to companies amounts to approximately F 30 million to date, but the Central Fund intends to develop its activities in this area in order to better satisfy the needs of companies.

If French financial aid in the electricity sector has placed important value on financing investments, it should be pointed out that this aid is not limited solely to this area, but strives to satisfy all needs of companies, in the area of investment as well as in the areas of studies, management and training. the objectives of French aid are comprehensive and not limited only to the investment sector. The importance of energy in economic development warrants the continuation of French aid for the development of organizations producing and distributing electricity in French-speaking Africa.

European Investment Bank Loans

Paris INDUSTRIES ET TRAVAUX D'OUTRE-MER in French Nov 78 pp 878-880

[Excerpts] An EEC banking institution specializing in financing investments contributing to specific economic objectives, the European Investment Bank's (EIB) main area of activity is the territory of member countries of the Community, in which it granted 89.2 percent of its loans in 1977, or 1.401 million units of account* [u.c.] out of a total of 1.571 million.

* Conversion rate of 25 September 1978 = 1 u.c. = F 5.60 = $1.24.

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However, since the first Yaounde Agreement signed in 1963, the EIB has become an important source of financing for projects contributing to economic developments in signatory African nations. The Lome Agreement, which took effect on 1 April 1976 and to which 53 African, Caribbean and Pacific nations currently adhere, has given new vigor to this mission. This agreement, and the decision of the Communities' Council for Overseas Territories and Countries, provides for the European Bank to grant loans amounting to 400 million u.c. from its own resources, represented by its capital, its reserves and especially the proceeds from its loans in national and international money markets.

Under the Lome Agreement, the Bank's loans generally include an interest reduction of three points: 100 million u.c. have been set aside for this purpose from the resources of the European Development Fund, of which 101 million u.c. are also administered by the EIB for aid in the form of venture capital.*

In view of the various types of financing offered by the Lome Agreement and the size of subsidies and loans with very favorable stipulated conditions, amounting to some 2.6 billion u.c. administered by the European Communities' commission, the Bank's loans--which are added to this total --are reserved for projects contributing directly or indirectly to the growth of economic productivity in general; in the production sector, the results of the financed projects' operations must be adequate to provide interest servicing and amortization of the loans.

The European Bank's area of activity has also been extended to include various countries in the Mediterranean Basin, first Greece, then Turkey and more recently, Portugal, Yugoslavia and Lebanon. Cooperative agreements have been concluded between the Community and nine other countries in this area and will become effective shortly. They provide for the EIB's operation, up to stipulated limits, in the form of loans for investments contributing to the economic development of these countries.

Priority Investments

On 30 September 1978, the EIB's program for investments in the electricity sector outside the Community was given concrete shape in the form of 22 loans, or more than 300 million u.c., contributing the actualization of

* These venture-capital operations may take the form of minority stockholdings in the capital of a company on behalf of the Community, aid to an institution or nation so that they may share in the capital themselves, subordinate loans whose repayment becomes due only after payment of priority loans, or even conditional loans whose repayment becomes due only after certain conditions are satisfied, indicating that the project has overcome the inherent difficulties of the initial period or that it has reached a given stage of profitability.

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more than 3.3 billion u.c. in investments in 12 countries (including 7 signatories of the Yaounde II and Lome Agreements). The total installed power, as a result of these loans, represents more than 3400 MW. These loans have also contributed to the construction of high-voltage lines, making possible the development of regional or national systems needed for adequate use of production capacities and supply of users.

In every case, the investments to be financed are maintained in accordance with the government of the respective nation and are among the priority objectives of the country's development plans. The direction of projects and granting of financing by the EIB are carried out in accordance with the terms and procedures stipulated by its bylaws, which are similar in practice to the regulations observed by other long-term international financing institutions, since they must rely on the money market in order to obtain the resources needed to finance their loans.

The continued economic and industrial development of the countries in question depends on the construction of these installations. They also contribute to improving the standard of living of peoples, both directly by serving households and indirectly by effects, in terms of jobs and income, of the establishment of new businesses made possible as a result. Those projects which develop national energy resources, particularly hydroelectric installations and their complementary transmission lines, have also had a positive effect on the respective countries' balance of payments by curbing their energy imports, particularly hydrocarbons. In this way, they comply with the objectives of developing the energy resources of developing countires, whose need has been pointed out in various international circles and for which the Community has recently reaffirmed its will to contribute its active support.

It must be pointed out that in setting up its financing, the EIB cooperates with the European Communities' Commission with the specialized bilateral agencies of member countries, such as the Central Fund for Economic cooperation (CCCE), the Commonwealth Development Corporation (CDC) and the Reconstruction Credit Bank (KFW), with multilaterial institutions such as the World Bank, the African Development Bank and, more recently, with various bilateral and multilateral banks and funds of the Arab world.

Africa, the Caribbean and Pacific

As of 30 September 1978, the EIB's operations for electrical investments in Africa and in the Pacific involved a total of 72.2 million u.c. in seven countries. Four loans were granted in the framework of the second Yaounde Agreement totaling 18.3 million u.c., and six loans, all with the three-point interest reduction, under the Lome Agreement, for a total of 53.9 million u.c. These loans have contributed to the actualization of investments estimated at some 600 million u.c. and include an increase in production capacities of more than 600 MW, in addition to several expansions or interconnections of systems.

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In Cameroon, the Bank granted two loans in 1967 and 1971 to ENELCAM (Cameroon Electric Power). The first loan, for 4 million u.c., involved the construction of a storage dam on the Sanaga River and the installation of two plants of 20 MW each in the Edea hydroelectric complex; these installations were mainly intended to satisfy the demand of the cities of Edea, Douala and Yaounde and their industries. The second loan (3.5 million u.c.) financed the construction of a dam on a tributary of the Sanaga River and the installation of three additional plants of 20.8 MW each in this same complex. In 1976, new financing of 13.5 million u.c. to the Cameroon National Electricity Company, which had absorbed ENELCAM in 1974, involved the construction of a dam and a hydroelectric power plant equipped with three 48-MW units, or an installed power of 144 MW, at Song-Loulou on the Sanaga River, upstream from the Edea complex, as well as transmission lines and interconnection stations, improving distribution in the south and west of the country.

In the Ivory Coast, the European Bank contributed, with a loan of 11 million u.c. to the Ivory Coast Electric Power Company (EECI) in 1977, to the construction of a control and modulation center. This center will make possible efficient use of the capacities of the power stations of the interconnected system by facilitating energy transmission to all points of the system as needed; these investments also included the installation of 29 kilometers of 225-kilovolt lines for supplying the Abidjan area, derived mainly from hydraulic energy.

In Ghana, 10 million u.c. were lent to the Volta River Authority in 1976 for the construction of the Akosombo Dam on Lake Volta, the construction of a new power station equipped with four turbogenerators with a total capacity of some 140 MW and for expanding the distribution system, particularly to cope with the growth of industrial demand.

In Liberia, 4.2 million u.c. were granted to the Liberia Electricity Corporation in 1978 for expanding a thermal power station at Bushrod, on the outskirts of Monrovia, the capital. The investments consisted mainly of adding two diesel generators with a unit power of 14 MW to an existing power station, to handle the growth of household demand and of various industrial and small-scale projects.

On Mauritius, the European Bank has also granted two loans to the Central Electricity Board (CEB) in 1975 and 1976. The first loan (1.75 million u.c.) involved the expansion of production capacities of the Fort Victoria thermal power station through the addition of six diesel units with a total capacity of 36 MW; the second loan (2 million u.c.) financed the installation of two other units of 6.6 MW each.

In Zaire, a loan of 9 million u.c. with special terms was granted to the government in 1970 from the resources of the European Development Fund supported by the budget of member nations. This loan was granted for the construction of systemsoriginating from the Inga hydroelectric power

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plant and serving the capital, Kinshasa, and suburban areas as well as other cities in the province of Bas Zaire, notably Matadi and Boma.

Finally, it must be noted that in addition to formal financial agreements concluded between the Community and countries in the Mediterranean Basin under the Lome Agreement and which are expected to take effect within the near future, other loans have already been ordered and could give new breadth within the next few months to the European Bank's operations in the electrical energy sector.

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BOTSWANA

ABAED LOAN TO FIGHT AGAINST FOOT-AND-MOUTH DISEASE

Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 15 Dec 78 p 3455

[Text] The Arab Bank for African Economic Development has just granted a $2.2 million loan to Botswana. The loan is reimbursable in 7 years after a deferred amortization period of 3 years. It has an annual 2 percent interest rate and it is intended for use in the fight against foot-and-mouth disease in the context of a project in the amount of $6.25 million to which the European Development Fund and the government of Botswana will contribute $1.92 million and $2.11 million respectively. The foot-and-mouth disease epidemic which affected Botswana in November 1977 caused stockyards to close for two months and entailed considerable loss of revenue. The project will be implemented in two phases:

--The urgent shipment (foot-and-mouth being an extremely contagious disease) to Botswana of a laboratory on wheels to allow for the immediate take-off of a campaign for veterinary analyses in vivo which must be conducted by specialized consultants and must be followed by the manufacture and experimentation of the vaccines needed to immunize cattle and thus stamp out the disease. Once the virus has been isolated and the vaccine prepared, it is planned to consolidate the rhythm of manufacture in order to reach production of 2 million doses of vaccine per year for an initial two-year period.

--The establishment in Gaborone of a manufacturing laboratory and related installations which will boost manufacturing to 15 million doses of vaccine per year in order to satisfy needs on a larger scale and provide authorities with the means to strengthen prophylactic sanitary measures (the vaccine provides durable protection) and to efficiently face any recurring epidemics.

Botswana has already been the beneficiary of a $5.4 million long-term loan granted by the Arab Fund for Special Assistance to Africa and regards this project as prioritarian, since it is intended to protect the health of the national cattle wealth and to promote production and export of related products; foot-and-mouth disease is actually considered one of the worst scourges in this field.

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BRIEFS

COOPERATION WITH USSR--The new ambassador of the Soviet Union in Cameroon, Tikhonov Vadim, presented his letters of credence to President Ahmadou Ahidjo, on 5 November. That audience was an opportunity for CAMEROON TRIBUNE to review the relations maintained between the two countries. In 1965, the visit to Moscow by the Cameroon chief of state was an important step on the basis of which exchanges have developed incessantly. Cooperation between both countries affects important sectors. In the field of education, thanks fo assistance from the USSR, Cameroon has been provided with two professional technical schools: the Dschang College of Agriculture and the Mbalmayo School of Waterways and Forests. This last-mentioned establishment was inaugurated by President Ahidjo last year. Both schools are provided with instruction and laboratory equipment made in the USSR. Soviet instructors are members of the teaching staff. This cooperation is also carried out in the field of trade. The turnover of trade between the USSR and Cameroon amounted to close to 12 billion CFA [African Financial Community] francs, in 1976. The USSR buys cocoa, peanuts and wood primarily. Establishment of a mixed coporation, CATECO [Cameroon Automobile, Technology and Trading Corporation], has played a large part in increasing the volume of Soviet-Cameroon trade. This corporation specializes in the sale and maintenance of Soviet automobiles. CATECO has good prospects. At present, this corporation sells not only Soviet cars and trucks, but also tractors, cranes and various equipment for food and processing industrial enterprises. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 17 Nov 78 p 3036] 10042

ADMINISTRATIVE REFORM--Some important decrees pertaining to a reform of Cameroon's administration were signed by President Ahidjo, on 9 November. These decrees pertain especially to the establishment of a Central Market Bureau and to the powers of the heads of administrative districts and of the organizations and personnel assisting them. CAMEROON TRIBUNE, which devotes its editorial to these decrees, stresses the "greater concentration of the central government" that is going to stem from them. Thus, it adds, the decree specifying the powers of the heads of administrative districts extends their jurisdiction. The governor, in particular, as the editorial writer points out, handles the general direction of the civil

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services in the province, with the exception of justice, under the authority of the cognizant ministers. In the opinion of that newspaper, the establishment of the Central Public Market Bureau, under the president of the republic, is "important," because, formerly, those markets, "straddling under several ministries, required much time to be audited." The daily also emphasized the fact that delegations of budgetary credits have been computerized and procedures for granting pensions, life annuities and death benefits have been simplified. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 17 Nov 78 p 3036] 10042

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BRIEFS

PREMIER'S DIALOG WITH BUSINESSMEN--The prime minister of the Central African Empire, Henri Maidou, presided over a meeting, held on 18 November, with the leading businessmen and merchants of the CAE [Central African Empire], as well as with representatives of chambers of commerce. Maidou, who wants maintain a "dynamic, enriching, productive" dialog with the leaders of Central African economy, drew a rather gloomy picture of the economic situation and asked the participants in the meeting to assist him in remedying it. He especially censured the following: Delays in payment of taxes observed in many enterprises (at present one-third of the taxes due for fiscal year 1978 have not been paid and investigating committees are striving to remedy this situation). An alarming decrease in merchants' inventories, leading to a number of interruptions in supply for essential products like flour, sugar, cement, spare parts. Failure to respect price regulations. A decline in investments, probably due to the uneasiness of potential investors. In this respect, the prime minister pointed out that his government was devoted to the principles of liberal economy and free competition and that, consequently, the investors' lack of confidence seemed groundless. In conclusion, Maidou invited the banks to demonstrate dynamism in granting credits and he emphasized the fact that his government was going to undertake large-scale highway maintenance jobs for the purpose of promoting trade. He also insinuated that certain state-managed economic sectors might be opened up to private initiative. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 1 Dec 78 p 3325] 10042

CHINESE AID TO AGRICULTURE--The ambassador of China in the CAE presented a gift of agricultural equipment, worth 57 million CFA [African Financial Community] francs, for the imperial farm, to Emperor Bokassa, in the imperial court of Berengo, on 16 November. It should be noted that Chinese agricultural technicians have been working on the imperial farm for a year now. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 1 Dec 78 p 3325] 10042

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BRIEFS

MONEY LENDERS' CONFERENCE--A conference of countries and development aid agencies concerned with the work of realinement of the Congo-Ocean Railroad (CFCO) was held from 24 to 26 November in Pointe Noire, the economic capital of Congo, under the chairmanship of the Congolese minister of Public Works and Transportation, Camille Dhello. In his speech, the minister pointed out that "Congo has had the pleasure of seeing a partial implementation of promises for supplemtary aid during the last year" and he thanked the representatives of the agencies supplying that assistance. Ten agencies participated in that conference. They are the European Development Fund (EDF), the Central Fund for Economic Cooperation (CCCE), the Congolese Amortization Fund (CCA), the Canadian Development Agency, The Canadian Survey Bureau for Realinement, the Central African Countries Bank (BEAC) the Arab Bank for Economic Development in Africa (BADEA), the World Bank group and the Saudi Development Fund. The participants decided to hold a a coordination meeting, in the coming 6 months, for the purpose of determining the status of progress in the realinement job, cost of the project underway and experience acquired during execution of the job. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 1 Dec 78 p 3327] 10042

ADMINISTRATION OF REFINERY--Rodolphe Adada, Congolese minister of Mines, stated recently that the Military Committee of the Party (CMP) was of the opinion, at the time of its last meeting, that it was advisable for Congo to have an "experienced" partner in the oil industry, in order to support it in managing the Pointe Noire refinery. Adada went on to say that that is why the Ministry of Mines and Energy has been made responsible for negotiation with a view to the establishment of a mixed company, with certain partners, for the purpose of managing the national refinery. But the minister pointed out that the mixed company, which will assume all the financial burdens and all the rights pertaining to exploitation, will, nevertheless, have to pay rent to the Congolese State, owner of the refinery. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 1 Dec 78 p 3327] 10042

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BRIEFS

NEW UNESCO MEMBER--On 30 October, Namibia became the 145th member country of UNESCO by decision of the General Conference of the organization. Namibia's admission was acquired by a majority far in excess of the two-thirds required by regulations. Thirteen countries, including the five Western countries in the "contact group", abstained. As the legal authority administering that territory until its independence, the Council of the United Nations had requested this admission for Namibia, so that it could participate in the work of UNESCO as a full-fledged member. Since November 1977, Namibia has already been a member of FAO and since June 1978 of ILO. Until today, it was represented in UNESCO by the presence of a SWAPO observer. Now the fate of this observer risks giving rise to a legal controversy. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 10 Nov 78 p 2985] 10042

NEW AIRLINE NAME--The South-West Airways company announced on 30 October that it was changing its name and was designated from then on as Namib Air, in anticipation of the transformation of the Southwest African territory into Namibia. The first aircraft bearing the company's new name made its inaugural flight on the same day. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 10 Nov 78 p 2985] 10042

SAUDI GIFT FOR REFUGEES--Saudi Arabia has made a gift of $1 million for Namibian refugees. This gift was presented by the ambassador of Saudi Arabia in Dakar to Dr Otto Hagenbuchle, resident-representative in Dakar of the United Nations High Commissioner for Refugees. [Text] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 10 Nov 78 p 2985] 10042

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SENEGAL

EXPANSION OF DAKAR PORT

Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 1 Dec 78 p 3315

[Text] The delegates to the Ministerial Conference of West and Central African Countries on Sea Transportation, held in Dakar on 15 and 16 November, visited the port of the Senegalese capital.

At the time of chat visit, Ndao, an official of the autonomous port of Dakar, stated to LE SOLEIL that the situation of ports in the region was "undergoing full expansion."*

This growth is probably due not only to the amount of sea traffic (for Senegal, for example, 95 percent of its trade passes through the port), but also to the development of port infrastructures making it possible to service ships better. This expansion finds expression in speed of operations, a speed that decrease the ships' waiting time.

The port of Dakar, containing 220 hectares of water area, includes 45 hectares of earthworks and 57,000 square meters of sheds. Altogether, its docks have an extent of 9 kilometers and are covered by 25 kilometers of railroad.

The port turns into the Public Treasury an annual sum of between 500 million and 1 billion CFA [African Financial Community] francs.

Among the most recent improvements, mention should be made of the construction of a 1,200-ton boat lift, equipped with four boat sheds. This lift, now in operation, cost some 860 million. This device contributes to meeting the demand for repair of the fishing fleet, a fleet that is increasing every year.

But the project (underway at present) presented by the port authorities as the most important operation at the present time involves construction of the huge fishing jetty, 1,500 meters long, 7 and 10 meters deep,

* Statistics for the port of Dakar, in MARCHES TROPICAUX ET MEDITERRANEENS for 6 October 1978, p 2650.

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covering 8 hectares. Other construction jobs are in progress: supports for the wharf of Mole 2, increase in storage facilities and modernization of the electrical installations in the entire port.

Another project involves the container terminal. It will consist of a roll-on roll-off platform and mole with 1,000 meters of wharf, 10 meters deep, for offloading containers. Earthworks required for storing containers will be reached primarily from sea. Earthfill work is already in progress.

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